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SINGLE-STALK COTTON CULTURE AT SAN ANTONIO.

By ROWLAND M. MEADE, *Scientific Assistant, Office of Crop Acclimatization.*

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INTRODUCTION.

Single-stalk cotton culture, as explained and discussed in previous publications of the Bureau of Plant Industry,[1] has proved more satisfactory than other systems of culture in various sections of the cotton belt, especially in regions having short seasons. This is so for two reasons: (1) Single-stalk culture promotes earliness and (2) it increases the acre yield. The single-stalk system of cotton culture embraces late thinning and short spaces between the plants in the row. The late thinning suppresses the vegetative branches and restricts the size of the plants, so that they can be left from 6 to 12 inches apart in the row without injurious crowding. The plants are left close together, so that the row space is more efficiently utilized and higher yields are obtained than by the common system of wide spacing.

[1] The publications of the Bureau of Plant Industry concerning the single-stalk system of cotton culture are as follows: "A New System of Cotton Culture," a paper in Circular 115; Farmers' Bulletin 601, "A New System of Cotton Culture and Its Application"; and Document 1130, "Single-Stalk Cotton Culture." Farmers' Bulletin 601 and the paper in Circular 115 explain the single-stalk system and give the results of experiments at Norfolk, Va., and in South Carolina. Document 1130 is an illustrated circular that shows how the vegetative branches are controlled and why larger yields are possible.

NOTE.—This bulletin will be of service generally in acquainting those who are interested in cotton growing with the several advantages to be gained through the application of single-stalk culture as compared with the more common methods. It will be particularly helpful to farmers and experimenters in locations similar to the San Antonio region.

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The period during which conditions are favorable for the setting of bolls in the region of San Antonio, Tex., is usually less than two months and frequently less than 30 days. In order to secure a good crop of cotton it is necessary, therefore, to practice the system of culture that will promote the production of the greatest number of bolls in the least time. For this reason the single-stalk system of culture has been looked upon as most nearly meeting the requirements of local conditions. To compare the merits of the common practice of wide spacing and the new single-stalk system, a series of tests was conducted in 1914 on the United States experiment farm at San Antonio. The results of these tests showed striking differences in favor of single-stalk culture.

In spite of the fact that the season was somewhat out of the ordinary, in that two months of excessively wet weather were followed by two months of drought, it was even more favorable for the production of cotton than ordinary seasons. Yields higher than the average were secured from rows grown according to the ordinary method of culture, even though the period during which bolls were set was shorter than normal. Whether the results in a normal season would have been more or less in favor of the single-stalk culture can not be definitely stated, but results of previous experiments indicate that even if the season had been normal the differences in the two methods of culture would have been comparatively the same.

COTTON PRODUCTION IN THE SAN ANTONIO REGION.

In the San Antonio region the development of cotton seedlings is frequently retarded because of the low temperatures that prevail often as late as the middle of May. As a result of exposure to low temperatures the plants are variously affected with the disorder known as leaf-cut,[1] some only slightly, others so seriously that the terminal buds abort. From the middle of May to early July the plants usually develop normally and constantly, June being especially favorable for their growth. Flowering commences from the first to the middle of June and reaches the maximum early in July. About the middle of July a drought usually ensues and continues until some time in August. This droughty condition causes the flowers to fall from the plants and only a very small percentage of the flowers that open in that period develop into bolls. By the end of July the plants cease to grow and very few flowers open. Rains usually fall during the latter part of August, and if the succeeding two months continue warm and the weevils are not numerous a "top crop" is sometimes produced.

[1] For a detailed explanation of the nature of this disorder, see the paper entitled "Leaf-Cut, or Tomosis, a Disorder of Cotton Seedlings," in Circular 120 of the Bureau of Plant Industry.

Usually the boll weevils do not appear in sufficient numbers to interfere materially with the setting of the crop before the first of July. During seasons of continued drought they are unable to reproduce rapidly enough to overcome the mortality caused by the falling of punctured squares and the action of the hot, dry atmosphere, and consequently they inflict little damage. In other words, drought is to a degree a beneficial factor in the production of a cotton crop in this region.[1] During more humid seasons, however, weevils infest practically all buds and squares by the middle of July.

From these facts it will be seen that cotton crops in the region of San Antonio must ordinarily be set within a month or a month and a half after flowering begins. Under the ordinary system of wide spacing, yields are usually rather low, averaging less than half a bale to the acre. During the season of 1914, however, nearly a bale to the acre was secured by the single-stalk system. Moreover, the bolls that produced this crop were set in less than 30 days.

The season of 1914 was exceptional only in the distribution of the rainfall, which tended to shorten the period of setting the crop. While the normal rainfall for April and May, respectively, is less than 3 inches, in 1914 more than 6 inches fell during each of these months. No rain fell from the first of June until the middle of August, so that a continued drought followed an extended period of rainfall.

PLAN OF TEST.

A plan of the field on which the ordinary system of wide spacing and the new single-stalk system of cotton culture were tested and compared in 1914 is shown in figure 1. In order to facilitate comparisons, the field was divided into four sections, which are designated as A, B, C, and D, respectively. All of the sections were planted with the same variety of cotton, Acala, a promising new type recently acclimatized from Mexico, which has given excellent results for several seasons at San Antonio.

In section A the two systems were compared in alternating rows; that is, single rows in which the plants were thinned early to 2 feet apart alternated with single rows in which the plants were thinned late and left less than 10 inches apart.

In section B 4-row blocks grown by the common system of culture alternated with 4-row blocks grown by the single-stalk system of culture.

In section C there were three blocks of five rows each. The plants in the five rows of each block were spaced to 6, 9, 12, 18, and 24 inches apart, respectively. The blocks were thinned on three different dates,

[1] See Bulletin 220 of the Bureau of Plant Industry, entitled "The Relation of Drought to Weevil Resistance in Cotton."

the first representing early, the second late, and the third very late thinning.

In section D the two systems were compared in alternate rows, the rows being planted 3, 4, 5, and 6 feet apart.

A guard row between sections A and B was not thinned at any time during the season.

Throughout this paper the rows representing the common practice of wide spacing are designated as wide-spaced rows and those representing the new system of close spacing are referred to as single-stalk rows.

PLANTING AND GERMINATION OF SEED.

It has been found desirable to plant from 25 to 30 pounds of seed to the acre if the rows are 4 feet apart, in order to secure a stand

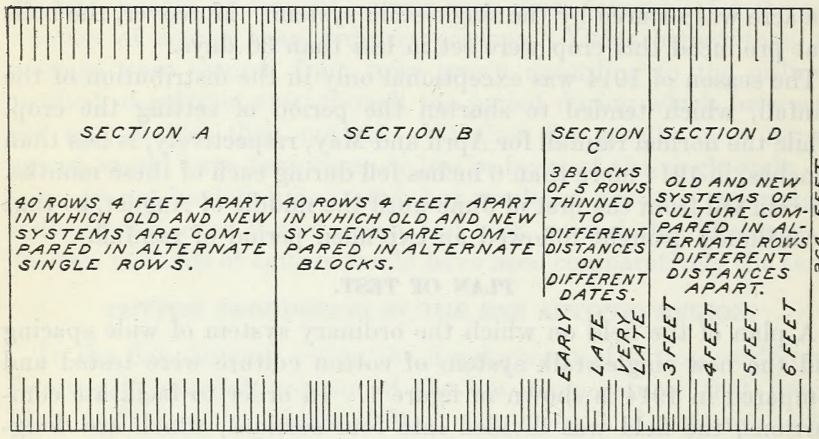
SECTION A
40 ROWS 4 FEET APART IN WHICH OLD AND NEW SYSTEMS ARE COMPARED IN ALTERNATE SINGLE ROWS.
SECTION B
40 ROWS 4 FEET APART IN WHICH OLD AND NEW SYSTEMS ARE COMPARED IN ALTERNATE BLOCKS.
SECTION C
3 BLOCKS OF 5 ROWS THINNED TO DIFFERENT DISTANCES ON DIFFERENT DATES.
EARLY
LATE
VERY LATE
SECTION D
OLD AND NEW SYSTEMS OF CULTURE COMPARED IN ALTERNATE ROWS DIFFERENT DISTANCES APART.
3 FEET
4 FEET
5 FEET
6 FEET
264 FEET

FIG. 1.—Plan of the field at San Antonio, Tex., in which the common system of wide spacing and the new single-stalk system of cotton culture were tested and compared in 1914.

in which the young plants become crowded sufficiently to restrict the development of the vegetative branches. Accordingly, the seed for the San Antonio test was sowed at the rate of about 30 pounds to the acre. The planting was done on April 14, with a 2-row planter.

Heavy rains and low temperatures rendered the conditions unfavorable for the germination of seed; but on account of the high rate of seeding a good stand was obtained. Nearly all rows had a short "skip" or two in which no plants appeared, but none of these skips were more than a few feet long, and it is believed that they had little effect on the yields. The skips were more numerous in section B than in any other section of the field, but were as frequent in single-stalk blocks as in wide-spaced blocks, and they therefore balanced the comparison of the two systems. Aside from these occasional skips, the stand was very satisfactory.

CHOPPING WIDE-SPACED ROWS.

In the region of San Antonio the general practice is to chop the plants when they are still very small, leaving one or two plants every 18 to 24 inches apart. This is usually done as soon as possible after germination, depending generally on weather conditions or when the choppers are best able to do the work, rather than on the stage of the plants' development. In the San Antonio test an attempt was made to approximate this practice in the wide-spaced rows. The plants were spaced to 2 feet, but owing to rain the chopping was delayed until May 6, 22 days after planting. At this time the plants were about 3 or 4 inches high and had one or two foliage leaves in addition to the seed leaves.

THINNING SINGLE-STALK ROWS.

In the single-stalk rows it was planned to leave the plants from 6 to 8 inches apart, and except in the short skips it was possible to secure the spacings desired. In order to have the spacing as accurate as possible and to leave the most promising plants the thinning was done by hand.

Care was exercised near the skips to leave the plants slightly closer together, in order that the effect of the open space might to a degree be overcome and that the development of vegetative branches might be prevented. Later observation showed, however, that one or two vegetative branches generally developed on plants next to skips or at the ends of rows.

The plants developed slowly during the cool, cloudy days of April and early May, so that it was late in May before they were in the proper condition for thinning. Because of continued rains the thinning was not done, however, until June 2. At this time the plants were about 12 inches high and had about eight full-grown leaves. On some of the most precocious plants fruiting branches had begun to develop. It is believed that had it been possible to do the thinning a week or 10 days earlier, when the plants had but five or six full-grown leaves and were only 8 or 10 inches high, it would have been more effective.

RESULTS OF THE TEST.

In comparing the wide-spaced and single-stalk systems of culture the following points were considered: Development of vegetative branches, rate of flowering, number of bolls set, number of locks in bolls, size of bolls, the form of rows, yields of seed cotton, and percentage and quality of lint.[1]

[1] The writer was greatly assisted in securing the data at different times during the season by Messrs. Robert E. Kerr, James Taylor, H. Gregory McKeever, G. B. Gilbert, and G. W. R. Davidson. There was at all times close cooperation with the staff of the United States experiment farm at San Antonio.

While comparative yields comprise the most important consideration in such tests as long as the quality of the fiber is not injured in the system giving the highest yield, it is important to know what factors influence productiveness. Since the success of single-stalk culture depends primarily on the suppression of vegetative-branch development, it is important to know how conditions of climate and culture affect the growth of these branches. The rate of flowering and the setting of bolls are directly associated and have considerable bearing on the yields. The number of locks in the boll is not important so long as good yields are obtained, but a great reduction in the size of bolls would, of course, be undesirable under any system of culture. The distance to which plants spread between rows, especially near the ground, is important, since it may affect cultivation, picking, etc., and the distance apart rows should be planted may be limited by this feature. Data on all of these points were secured only in sections A and B, which included the largest part of the field. On some of the points, however, data were obtained from all sections.

DEVELOPMENT OF VEGETATIVE BRANCHES.

During warm and favorable spring weather in the region of San Antonio, cotton plants in wide-spaced rows develop five or six vegetative branches, but if the weather remains cool only two or three branches may develop. Though the development of vegetative branches was restricted more than usual by low temperatures in the season of 1914, it was possible by leaving the plants crowded in the rows to induce a further reduction in the number of branches. This can be clearly seen in Table I, which presents the average number of vegetative branches on plants in wide-spaced and single-stalk rows of Acala cotton in sections A and B. These averages represent the census from 25 consecutive plants in each of the rows.

TABLE I.—*Average number of vegetative branches on plants in wide-spaced and in single-stalk rows of Acala cotton in sections A and B, San Antonio, Tex., 1914.*

Alternate single rows (section A).				Alternate 4-row blocks (section B).			
Single-stalk rows.		Wide-spaced rows.		Single-stalk rows.		Wide-spaced rows.	
Row No.	Average of 25 plants.	Row No.	Average of 25 plants.	Row No.	Average of 25 plants.	Row No.	Average of 25 plants.
3	0.48	4	1.56	62	0.40	58	1.56
5	.56	6	1.60	63	.64	59	1.68
7	.50	8	1.72	64	.60	60	2.00
9	.40	10	1.64	65	.64	61	1.20

Table I shows that during the cool spring of 1914 an average of 1.6 vegetative branches developed on the wide-spaced plants, while the average on the single-stalk plants was 0.53 branch per plant. The range of averages in wide-spaced rows was from 1.2 to 2 branches per plant, while in single-stalk rows it was from 0.4 to 0.64 branch per plant.

FLOWERING RECORDS.

Beginning with June 17, when the first flowers appeared, a daily flower census was taken in sections A and B to compare the rate of flowering of wide-spaced and single-stalk rows. This was continued for 20 days. The results of the census are given in Table II.

In the first part of Table II, which represents the census in section A, it may be seen that for three days more flowers opened in the wide-spaced rows than in the single-stalk rows, while in the second part of the table, which represents the census taken in section B, this was true only on the first day that flowers opened. After the flowers in the single-stalk rows began to outnumber those in the wide-spaced rows the lead was maintained throughout the entire period. The increase in the number of flowers in single-stalk rows over that in the wide-spaced rows ranged from 30 to 204 per cent, the average for the 20-day period being 125.6 per cent in section A and 135 per cent in section B.

At the end of the 20-day flower census, July 6, the drought had become severe, and most of the flowers produced after that date failed to develop into bolls. Consequently the census for the entire field was not carried further, but was continued for 20 days longer on eight representative rows in each of sections A and B. None of the flowers opening after July 10 produced bolls, so these flowers had no part in increasing the yields of either single-stalk or wide-spaced rows. Their numbers are given, however, in Table III for four 10-day periods in order to show that the single-stalk rows continued to produce more flowers than the wide-spaced rows for the extended period.

Table III shows that at the end of 40 days 12,574 flowers had opened on 20 wide-spaced rows in section A, while 84.4 per cent more, or 23,189, had opened on 20 single-stalk rows. In section B 20 wide-spaced rows opened 13,725 flowers, while 20 single-stalk rows opened 78 per cent more, or 23,401 flowers.

TABLE II.—*Daily flower census of single-stalk and wide-spaced plants of Acala cotton at San Antonio, Tex.*

Row Nos.	June, 1914.														July, 1914.						Total.		
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	First 10 days.	Second 10 days.	For 20 days.
Alternate single rows (section A):																							
1, single stalk	0	0	0	0	1	0	0	7	3	11	25	52	49	76	107	148	247	173	212	226	22	1,315	1,337
2, wide spaced	0	0	0	2	2	0	2	10	10	12	25	17	25	38	66	85	116	83	101	119	38	675	713
3, single stalk	0	0	1	0	4	3	3	16	17	23	43	64	97	121	149	200	332	228	201	356	67	1,791	1,858
4, wide spaced	0	1	1	2	5	7	10	5	18	11	31	11	64	43	77	106	132	123	118	151	60	856	916
5, single stalk	0	0	0	1	1	6	16	28	41	27	67	68	110	124	200	236	323	317	312	289	120	2,046	2,166
6, wide spaced	0	0	0	1	4	4	12	5	14	12	24	34	48	69	90	110	138	146	130	141	52	930	982
7, single stalk	0	0	2	3	6	1	12	9	34	38	60	74	104	120	175	231	309	261	274	285	105	1,893	1,998
8, wide spaced	0	1	0	3	4	6	7	8	18	12	24	29	39	45	66	99	87	77	80	116	59	662	721
9, single stalk	0	0	0	2	8	12	25	17	47	87	64	90	146	143	207	237	332	288	294	269	198	2,070	2,268
10, wide spaced	0	0	0	6	2	7	12	13	23	30	38	37	57	63	101	131	144	144	132	128	93	975	1,068
11, single stalk	0	0	0	4	1	16	27	23	33	39	99	134	155	150	206	282	327	301	300	320	143	2,274	2,417
12, wide spaced	0	0	0	3	1	10	22	17	22	28	39	38	64	60	112	121	142	151	142	155	103	1,024	1,127
13, single stalk	0	1	1	8	8	19	33	27	58	86	110	87	172	189	200	324	325	243	250	279	241	2,179	2,420
14, wide spaced	0	1	3	4	4	12	30	15	25	22	41	40	43	72	69	126	121	98	99	121	116	830	946
15, single stalk	0	1	1	9	12	22	36	48	71	94	112	108	149	182	217	279	397	237	260	339	293	2,280	2,573
16, wide spaced	0	0	1	9	4	13	15	23	30	42	53	32	61	72	113	109	182	133	140	171	137	1,066	1,203
17, single stalk	0	0	1	2	6	13	26	31	44	51	93	96	124	159	169	224	301	221	262	235	174	1,884	2,058
18, wide spaced	1	0	4	3	2	7	15	12	17	20	45	43	51	52	93	122	129	116	120	124	81	895	976
19, single stalk	0	1	0	6	9	24	28	39	52	54	103	83	130	124	197	259	202	213	220	272	213	1,803	2,016
20, wide spaced	1	0	1	5	3	8	16	21	46	20	56	47	59	57	89	150	136	145	150	133	121	1,022	1,143
21, single stalk	0	0	0	4	8	25	32	31	46	49	82	103	134	153	197	216	305	243	260	223	195	1,916	2,111
22, wide spaced	0	1	1	3	1	5	14	14	32	18	31	29	49	53	72	93	118	109	107	111	89	772	861
23, single stalk	0	1	0	9	7	21	28	32	45	45	71	83	95	106	153	187	211	180	200	203	188	1,489	1,677
24, wide spaced	0	0	1	1	3	6	12	19	17	29	27	30	42	35	75	70	94	70	85	98	88	626	714
25, single stalk	0	0	1	4	8	19	43	42	61	71	101	110	145	173	190	226	292	226	250	249	249	1,962	2,211
26, wide spaced	1	0	0	2	2	12	20	14	35	25	47	47	54	55	91	110	133	76	90	127	111	830	941
27, single stalk	0	0	1	5	10	13	60	46	92	67	125	113	159	170	175	275	362	214	270	310	294	2,173	2,467
28, wide spaced	0	1	1	6	5	6	17	20	30	2	41	32	51	69	68	97	130	81	100	102	109	771	880
29, single stalk	0	0	1	7	4	22	32	55	34	50	94	104	137	159	150	282	305	234	267	282	255	2,014	2,269
30, wide spaced	0	1	0	8	10	15	15	23	17	19	31	45	51	68	82	104	118	125	132	131	108	887	995
31, single stalk	0	1	1	7	5	13	29	37	58	72	70	104	107	118	145	197	241	201	260	190	223	1,633	1,856
32, wide spaced	0	0	1	0	2	3	9	11	18	18	23	25	27	30	46	112	73	75	81	86	62	578	640

33, single stalk	0	0	3	6	3	14	25	35	57	49	78	71	128	100	129	149	267	176	200	224	192	1,522	1,714
34, wide spaced	0	1	1	3	4	6	16	20	29	18	52	27	48	52	75	55	161	89	94	120	98	773	871
35, single stalk	0	0	0	4	10	22	23	29	47	63	71	83	93	98	128	144	352	175	181	250	198	1,575	1,673
36, wide spaced	0	0	1	2	3	8	20	15	23	14	26	35	44	40	65	60	91	83	79	120	86	643	739
37, single stalk	0	0	0	0	5	10	25	19	39	41	66	67	96	93	103	135	194	103	112	178	139	1,147	1,286
38, wide spaced	0	0	0	0	2	5	9	15	18	14	24	35	29	30	36	55	76	39	52	83	63	459	522
39, single stalk	0	0	0	5	8	8	37	33	40	34	64	64	99	84	110	184	223	178	200	219	165	1,425	1,590
40, wide spaced	0	0	2	3	6	10	14	16	23	27	24	28	49	64	70	86	101	78	82	110	101	692	793
Total, wide-spaced rows	3	7	18	66	69	150	287	296	465	414	702	661	955	1,067	1,556	2,001	2,422	2,041	2,114	2,447	1,775	15,966	17,741
Total, single-stalk rows	0	5	13	86	124	283	540	604	919	1,051	1,598	1,758	2,429	2,642	3,307	4,415	5,847	4,412	4,785	5,198	3,624	36,391	40,015
Increase of single-stalk rows, per cent	....	−29	−28	30	80	89	88	104	98	154	127	166	154	147	112	120	141	116	126	113	105	128	125.6
Alternate 4-row blocks (section B):																							
42, wide spaced	0	0	2	2	9	11	20	19	18	17	28	36	41	32	49	83	93	70	78	99	98	609	707
43, wide spaced	0	0	1	3	5	8	11	14	13	13	24	37	24	33	48	65	94	61	65	98	68	549	617
44, wide spaced	0	0	0	3	2	3	5	9	16	13	18	13	18	20	34	52	75	45	52	77	51	404	455
45, wide spaced	0	0	0	1	3	2	7	12	8	13	19	14	24	23	32	47	66	44	56	48	46	373	419
46, single stalk	0	0	2	3	6	18	23	31	42	55	69	78	102	80	119	157	189	149	155	187	180	1,285	1,465
47, single stalk	0	0	5	2	9	11	34	24	39	56	84	83	130	143	151	201	293	170	212	215	180	1,682	1,862
48, single stalk	0	0	2	2	6	22	22	35	33	57	81	85	106	108	147	215	218	200	205	254	179	1,619	1,798
49, single stalk	0	0	0	5	3	11	26	29	30	31	89	88	114	103	136	177	248	159	196	217	135	1,527	1,662
50, wide spaced	0	0	1	4	7	8	19	16	17	23	13	30	34	40	72	71	87	74	92	106	95	619	714
51, wide spaced	0	0	2	2	3	11	8	19	24	19	31	38	38	57	76	85	122	79	109	115	88	750	838
52, wide spaced	0	0	1	3	1	8	6	13	14	13	25	23	37	46	50	59	68	71	78	89	59	546	605
53, wide spaced	1	0	1	1	4	4	9	18	13	13	24	27	36	37	57	71	94	83	71	103	64	603	667
54, single stalk	1	0	3	6	7	16	40	40	54	64	90	100	134	120	159	220	267	162	192	214	231	1,658	1,889
55, single stalk	0	0	2	4	9	20	45	46	73	59	119	83	114	134	148	216	267	211	151	239	258	1,682	1,940
56, single stalk	0	0	0	5	5	16	24	46	73	51	105	96	130	136	152	193	280	226	196	294	220	1,808	2,028
57, single stalk	0	0	1	1	2	6	12	27	43	53	80	60	84	81	134	168	190	158	152	194	145	1,301	1,446
58, wide spaced	1	2	3	5	8	13	12	25	36	26	45	31	48	61	104	84	111	116	100	136	131	836	967
59, wide spaced	2	1	3	4	8	15	19	24	42	21	56	26	77	65	98	115	144	117	107	133	139	938	1,077
60, wide spaced	1	1	1	2	4	13	13	16	27	20	37	38	48	66	83	109	87	113	110	132	98	823	921
61, wide spaced	0	0	1	0	2	3	10	15	21	16	27	22	39	37	57	77	93	76	73	104	68	605	673
62, single stalk	1	0	5	10	10	24	73	48	56	87	90	124	137	195	206	280	276	212	218	275	314	2,013	2,327
63, single stalk	0	1	4	12	23	30	31	52	48	71	104	97	147	175	187	249	280	268	247	248	272	2,002	2,274
64, single stalk	0	2	2	11	11	29	34	44	48	70	102	110	161	180	237	196	333	247	218	248	251	2,002	2,253
65, single stalk	0	0	1	5	11	33	61	34	58	99	92	140	169	185	247	286	365	233	335	293	302	2,345	2,647

TABLE II.—*Daily flower census of single-stalk and wide-spaced plants of Acala cotton at San Antonio, Tex.*—Continued.

Row Nos.	June, 1914.														July, 1914.						Total.		
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	First 10 days.	Second 10 days.	For 20 days.
Alternate 4-row blocks (section B)—Continued.																							
66, wide spaced	2	2	6	8	12	18	31	22	36	35	66	80	91	122	132	139	170	137	145	193	172	1,275	1,447
67, wide spaced	0	0	2	4	8	17	24	22	26	31	61	41	57	67	90	124	146	113	135	142	134	976	1,110
68, wide spaced	0	0	0	1	5	12	10	19	36	33	31	30	56	73	86	116	110	99	131	118	116	850	966
69, wide spaced	1	1	2	2	7	21	17	32	32	20	44	44	73	79	88	97	155	114	161	141	135	996	1,131
70, single stalk	0	0	3	11	11	30	44	67	62	75	109	121	152	188	211	224	346	289	257	324	303	2,221	2,524
71, single stalk	0	1	2	14	10	35	48	54	56	91	129	119	190	208	224	261	297	273	255	271	311	2,227	2,538
72, single stalk	0	0	0	1	18	17	35	29	54	58	100	77	142	157	208	231	333	219	231	275	212	1,973	2,185
73, single stalk	0	2	2	8	20	33	51	57	57	82	126	165	165	221	253	300	360	291	336	277	312	2,494	2,806
74, wide spaced	0	1	5	6	17	19	31	27	43	35	65	41	77	81	118	139	172	147	138	181	184	1,159	1,343
75, wide spaced	0	0	0	9	10	16	20	32	45	45	70	43	63	81	105	133	154	149	118	173	177	1,089	1,266
76, wide spaced	1	4	3	6	6	23	23	21	34	25	39	62	78	91	120	132	187	127	162	185	146	1,183	1,329
77, wide spaced	0	0	0	6	9	18	18	18	35	41	38	49	62	81	93	113	137	94	140	135	145	942	1,087
78, single stalk	0	4	4	5	14	28	54	69	65	89	116	124	169	188	236	224	297	225	232	257	332	2,068	2,400
79, single stalk	0	2	2	4	14	29	40	47	53	70	137	108	146	207	194	194	302	286	332	264	261	2,170	2,431
80, single stalk	0	2	4	9	16	30	38	68	53	90	126	156	179	196	246	241	250	281	222	239	310	2,136	2,446
81, single stalk	0	2	1	9	9	25	39	76	49	76	85	91	119	160	188	210	364	208	245	279	285	1,949	2,234
Total, wide-spaced rows	9	12	34	72	130	243	313	393	536	472	761	725	1,021	1,192	1,592	1,911	2,365	1,929	2,121	2,508	2,214	16,125	18,339
Total, single-stalk rows	2	16	45	127	214	463	774	923	1,046	1,384	2,033	2,105	2,790	3,165	3,783	4,443	5,755	4,437	4,587	5,064	4,993	38,162	43,155
Increase of single-stalk rows, per cent	−77	33	32	51	65	90	147	135	95	193	162	204	173	165	138	132	143	130	116	102	125	137	135

TABLE III.—*Flower census by 10-day periods in wide-spaced and single-stalk rows of Acala cotton in sections A and B, San Antonio, Tex., 1914.*

Row No.	Total flowers in alternate single rows (section A).					Row No.	Total flowers in alternate 4-row blocks (section B).				
	First 10 days, June 17–26.	Second 10 days, June 27–July 6.	Third 10 days, July 7–16.	Fourth 10 days, July 17–26.	For 40 days, June 17–July 26.		First 10 days, June 17–26.	Second 10 days, June 27–July 6.	Third 10 days, July 7–16.	Fourth 10 days, July 17–26.	For 40 days, June 17–July 26.
3, single stalk	67	1,791	2,222	1,620	5,700	58, wide spaced	131	836	1,533	1,289	3,789
4, wide spaced	60	856	1,231	1,079	3,226	59, wide spaced	139	938	1,455	1,215	3,747
5, single stalk	120	2,046	2,110	1,686	5,962	60, wide spaced	98	823	1,438	1,231	3,590
6, wide spaced	52	930	1,253	1,147	3,382	61, wide spaced	68	605	1,078	848	2,599
7, single stalk	105	1,893	2,064	1,553	5,615	62, single stalk	314	2,013	2,265	1,316	5,908
8, wide spaced	59	662	986	833	2,540	63, single stalk	272	2,002	2,373	1,098	5,745
9, single stalk	198	2,070	2,204	1,440	5,912	64, single stalk	251	2,002	2,292	947	5,492
10, wide spaced	93	975	1,375	983	3,426	65, single stalk	302	2,345	2,523	1,086	6,256
Total, single stalk	490	7,800	8,600	6,299	23,189	Total, wide spaced	436	3,202	5,504	4,583	13,725
Total, wide spaced	264	3,423	4,845	4,042	12,574	Total, single stalk	1,139	8,362	9,453	4,447	23,401
Increase, single stalk, per cent	86	128	78	56	84.4	Increase, single stalk, per cent	161	161	72	−3	87

NUMBER OF BOLLS SET.

To compare the efficiency of single-stalk and wide-spaced rows in the production of bolls, the total number of bolls set in rows 3 to 10 in section A and in rows 58 to 65 in section B were recorded. The results of the census are presented in Table IV.

TABLE IV.—*Bolls matured on wide-spaced and single-stalk rows of Acala cotton, 264 feet long, San Antonio, Tex., 1914.*

Row No. (section A).	Plants in row.	Bolls matured on row.	Bolls per plant.	Row No. (section B).	Plants in row.	Bolls matured on row.	Bolls per plant.
3, single stalk	350	2,021	5.7	58, wide spaced	100	1,129	11.3
4, wide spaced	120	750	6.2	59, wide spaced	98	1,070	10.9
5, single stalk	405	2,086	5.1	60, wide spaced	110	999	9.0
6, wide spaced	124	941	7.6	61, wide spaced	109	731	6.7
7, single stalk	377	2,120	5.1	62, single stalk	276	2,001	7.2
8, wide spaced	95	806	8.5	63, single stalk	303	1,669	5.5
9, single stalk	387	2,203	5.8	64, single stalk	290	1,465	5.0
10, wide spaced	108	893	8.3	65, single stalk	451	1,889	4.2
Average, single stalk	380	2,108	5.42	Average, single stalk	332	1,756	5.47
Average, wide spaced	112	848	7.65	Average, wide spaced	104	982	8.6
Increase, single stalk, per cent.	232	149	.....	Increase, single stalk, per cent.	222	78	.....

Table IV shows that plants in single-stalk rows set an average of five or six bolls each and those in wide-spaced rows about eight bolls, but the single-stalk rows contained about 225 per cent more plants than the wide-spaced rows, so that the total number of bolls set in single-stalk rows was greater. The single-stalk rows in section A set 149 per cent more bolls than the adjoining wide-spaced rows. In section B the single-stalk rows set 78 per cent more bolls than the wide-

spaced rows. The increase of inside rows, which approach most nearly the conditions of uniform field culture, was 47 per cent in favor of single-stalk rows. As will be shown later, the difference in yields from these rows favored single-stalk culture in about the proportion indicated by the number of bolls set.

NUMBERS OF LOCKS IN THE BOLLS.

Another census was made of bolls in single-stalk and wide-spaced rows to determine the percentages of 3, 4, and 5 locked bolls produced under the different systems of culture. Although the number of locks, or carpels, is always a variable character, the relative number of 3, 4, and 5 locked bolls is somewhat altered by different conditions of culture or climate. For instance, under irrigation a higher percentage of 5-locked bolls is produced than under dry-land culture.

In previous years it has been found that a lower percentage of 5-locked bolls was produced under the single-stalk system of culture than under the wide-spacing system, and the census taken at San Antonio in 1914 corroborates these former results. To determine the percentages of bolls with 3, 4, and 5 locks, a count of at least 300 bolls was taken in each row and the number of locks recorded. It was, of course, possible to secure the required number of bolls in less row space in the single-stalk rows than in the wide-spaced rows. The percentages of 3, 4, and 5 locked bolls in sections A and B are presented in Table V.

TABLE V.—*Ratio of 3-locked, 4-locked, and 5-locked bolls in rows of Acala cotton in sections A and B grown under the wide-spaced and single-stalk systems of culture, San Antonio, Tex., 1914.*

Row No.	Wide-spaced rows.					Single-stalk rows.				
	Locks in bolls—				5-locked bolls.	Locks in bolls—				5-locked bolls.
	3	4	5	Total.		3	4	5	Total.	
Alternate single rows (section A):					*Per cent.*					*Per cent.*
3							202	165	367	45.0
4		91	230	321	71.8					
5						5	193	188	386	48.7
6		168	201	369	54.5					
7						3	199	162	364	44.5
8	2	156	199	357	55.7					
9						2	200	155	357	43.4
10	1	149	202	352	57.4					
Alternate 4-row blocks (section B):										
58		154	181	335	54.0					
59		142	171	313	54.6					
60		161	207	368	56.2					
61		192	169	361	46.8					
62							171	133	304	43.7
63							186	146	332	44.0
64							180	120	300	40.0
65							130	202	332	60.8
Total	3	1,213	1,560	2,776		10	1,461	1,271	2,742	
Per cent	0.08	43.7	56.2	100	56.2	0.4	53.3	46.3	100	46.3

Table V shows that the range in percentage of 5-locked bolls in wide-spaced rows was from 47 to 72, with an average of 56, while in single-stalk rows the range was from 43 to 61 per cent, with an average of 46 per cent.

The production of a higher percentage of 4-locked bolls in single-stalk rows need not be considered an undesirable feature, since 4-locked bolls are more readily picked and the lint in them is fully as good as that in 5-locked bolls. The number of 3-locked bolls is insignificant.

SIZE OF BOLLS.

A comparison of the size of bolls was obtained by weighing 25 4-locked and 25 5-locked bolls from wide-spaced and single-stalk rows. The 4-locked bolls from single-stalk and wide-spaced rows weighed 5.04 and 5.32 grams, respectively, a difference of 0.28 gram. The weights of the 5-locked bolls were 5.64 and 6.2 grams for single-stalk and wide-spaced rows, respectively, the difference being 0.56 gram. Bolls from wide-spaced rows in both 4 and 5 locked samples weighed slightly more than those from single-stalk rows. In other words, 19 4-locked bolls from single-stalk rows have the same weight as 18 4-locked bolls from wide-spaced rows, and 11 5-locked bolls from single-stalk rows equal 10 5-locked bolls from wide-spaced rows. Five-locked bolls weighed from 0.6 to 0.8 of a gram more than 4-locked bolls. A slight reduction in the size of the bolls may be looked upon as a necessary consequence of producing a larger crop under the conditions of drought that ruled during the period of development of the bolls.

FORMS OF ROWS.

It has been previously shown that plants in wide-spaced rows developed more vegetative branches at the base than plants in single-stalk rows. The vegetative branches spread out from the base of the plants in the wide-spaced rows, forming rows that in cross section were broader near the ground than near the top of the plants.

Few plants in single-stalk rows had vegetative branches, so that the plants were made up of main stalks only. These grew erect and formed a narrow hedgelike row early in the season. Later, however, as the plants became taller, they leaned to one side or the other, making the rows broader at the top than near the ground. A cross section of a single-stalk row resembled an inverted cone or pyramid. This feature is clearly illustrated in Plate I, which shows an end view of a single-stalk row of Blackseed cotton. The contrast in form between the single-stalk and the wide-spaced rows is illustrated in Plates III and IV. At the end of the season the plants in the single-stalk rows were more than 6 inches taller than those in the wide-spaced rows, being 3.96 and 3.36 feet in height, respectively.

It was found possible to cultivate close to the plants in single-stalk rows without injury to the stalks. On the other hand, it was difficult to cultivate so close to the plants in wide-spaced rows without injuring the vegetative branches and the stalks.

All fruit was borne on the lower half of the plants in both kinds of rows, as may be seen in Plates I, III, IV, and in figure 1 of Plate V. As previously stated, the drought caused the shedding of all the bolls and flowers that would have developed after July 10. The bare stalks that appear above the fruited portions of the plants represent the growth made after the middle of July. Until the August rains relatively little growth was made, but after these rains the growth was very rapid. It was after this period of rapid growth that the taller plants in the single-stalk rows began to lean to one side or the other, resulting in the form of row shown in Plate I.

YIELDS FROM SECTIONS A AND B.

It has been shown that, compared with wide-spaced rows, the single-stalk rows in sections A and B showed far less vegetative-branch development, and that the plants grew to a greater height, thus facilitating cultivation between the rows; they produced flowers in greater abundance, and they set more bolls of about the same size as the others, though a higher percentage contained four instead of five locks.

It now remains to be shown how the two systems of culture compared from the standpoint of yield, which is the most important consideration, provided that the quality of the lint is not affected. The yields are recorded in Table VI.

Table VI shows that in section A, in which wide-spaced and single-stalk rows were compared in alternate rows, the yields from wide-spaced rows ranged from 9 to 14.4 pounds, while in single-stalk rows the range was from 17.6 to 31 pounds, the lowest yield from the single-stalk rows being 22 per cent greater than the highest yield from wide-spaced rows. These results are shown graphically in figure 2. The increase in the total yield of the single-stalk rows over the adjoining wide-spaced rows ranged from 63 to 227 per cent, with an average of 125.5 per cent. (See Pl. II.)

At the time the first picking was made, on August 11, 31 per cent of the total crop from the wide-spaced rows was picked, as compared with only 26 per cent of the crop from the single-stalk rows. In spite of this fact, the first picking from the single-stalk rows yielded 88 per cent more seed cotton than the wide-spaced rows. The second picking was made on September 8, when the yield obtained from single-stalk rows was 144 per cent more than that from wide-spaced rows.

TABLE VI.—*Yields from wide-spaced and single-stalk rows of Acala cotton in sections A and B, San Antonio, Tex., 1914.*

[Rows 4.1 feet apart, 264 feet long.]

Row No.	Number of plants.	Alternate single rows (section A). First picking, Aug. 11.	Second picking, Sept. 8.	Total picking.	Increase of single-stalk rows over wide-spaced rows.	Row No.	Number of plants.	Alternate 4-row blocks (section B). First picking, Aug. 11.	Second picking, Sept. 8.	Total picking.	Increase of single-stalk rows over wide-spaced rows.
		Lbs.	*Lbs.*	*Lbs.*	*Pr. ct.*			*Lbs.*	*Lbs.*	*Lbs.*	*Pr. ct.*
1, single stalk	404	3.3	27.5	30.8	161	42, wide spaced	100	2.8	8.9	11.7	.....
2, wide spaced	109	2.8	9.0	11.8	.....	43, wide spaced	104	3.2	11.8	15.0	.....
3, single stalk	350	6.1	21.0	27.1	153	44, wide spaced	103	2.1	10.5	12.6	.....
4, wide spaced	120	3.3	7.4	10.7	.....	45, wide spaced	83	2.6	7.8	10.4	.....
5, single stalk	405	6.9	21.8	28.7	109	46, single stalk	233	6.1	15.4	21.5	84
6, wide spaced	124	3.8	9.9	13.7	.....	47, single stalk	320	7.5	14.4	21.9	53
7, single stalk	377	7.2	22.2	29.4	227	48, single stalk	258	7.4	14.8	22.2	51
8, wide spaced	95	3.1	5.9	9.0	.....	49, single stalk	410	7.0	13.8	20.8	100
9, single stalk	387	7.4	21.7	29.1	122	50, wide spaced	100	4.0	8.3	12.3	.....
10, wide spaced	108	4.6	8.5	13.1	.....	51, wide spaced	113	4.4	12.0	16.4	.....
11, single stalk	361	8.6	22.4	31.0	142	52, wide spaced	100	3.4	9.4	12.8	.....
12, wide spaced	121	4.9	7.9	12.8	.....	53, wide spaced	93	3.5	9.9	13.4	.....
13, single stalk	362	10.2	20.8	31.0	161	54, single stalk	362	8.0	14.3	22.3	81
14, wide spaced	102	4.1	7.8	11.9	.....	55, single stalk	271	8.7	12.5	21.2	29
15, single stalk	351	10.0	19.9	29.9	114	56, single stalk	388	8.4	12.1	20.5	60
16, wide spaced	131	5.4	8.6	14.0	.....	57, single stalk	284	6.1	11.8	17.9	34
17, single stalk	350	7.0	19.6	26.6	96	58, wide spaced	100	6.0	8.0	14.0	.....
18, wide spaced	105	4.2	9.4	13.6	.....	59, wide spaced	98	6.0	9.6	15.6	.....
19, single stalk	286	8.9	19.5	28.4	97	60, wide spaced	110	5.5	8.8	14.3	.....
20, wide spaced	138	4.8	9.6	14.4	.....	61, wide spaced	109	3.5	6.8	10.3	.....
21, single stalk	342	7.1	19.3	26.4	126	62, single stalk	276	10.0	14.6	24.6	76
22, wide spaced	100	2.9	8.8	11.7	.....	63, single stalk	303	10.3	8.4	18.7	20
23, single stalk	283	4.9	18.3	23.2	117	64, single stalk	290	10.6	6.6	17.2	20
24, wide spaced	100	3.6	7.1	10.7	.....	65, single stalk	451	11.0	11.6	22.6	119
25, single stalk	380	8.4	14.1	22.5	63	66, wide spaced	114	7.5	6.3	13.8	.....
26, wide spaced	132	4.4	9.4	13.8	.....	67, wide spaced	107	6.8	7.8	14.6	.....
27, single stalk	396	8.9	21.6	30.5	135	68, wide spaced	128	5.2	8.3	13.5	.....
28, wide spaced	121	3.6	9.4	13.0	.....	69, wide spaced	133	6.4	6.7	13.1	.....
29, single stalk	416	7.6	21.3	28.9	121	70, single stalk	370	11.1	12.3	23.4	69
30, wide spaced	127	4.3	8.8	13.1	.....	71, single stalk	399	13.3	9.0	22.3	53
31, single stalk	319	6.9	19.5	26.4	161	72, single stalk	413	11.4	9.3	20.7	53
32, wide spaced	103	2.8	7.3	10.1	.....	73, single stalk	431	13.4	11.8	25.2	92
33, single stalk	354	5.3	20.6	25.9	101	74, wide spaced	126	6.4	6.3	12.7	.....
34, wide spaced	131	3.7	9.2	12.9	.....	75, wide spaced	128	7.3	9.0	16.3	.....
35, single stalk	292	.....	[a]20.9	20.9	95	76, wide spaced	136	8.6	8.4	17.0	.....
36, wide spaced	110	.....	[a]10.7	10.7	.....	77, wide spaced	106	6.9	6.1	13.0	.....
37, single stalk	295	.....	[a]17.6	17.6	83	78, single stalk	409	12.2	10.5	22.7	79
38, wide spaced	100	.....	[a]9.6	9.6	.....	79, single stalk	348	11.5	7.3	18.8	15
39, single stalk	268	.....	[a]21.6	21.6	90	80, single stalk	389	10.9	9.5	20.4	20
40, wide spaced	122	.....	[a]11.4	11.4	.....	81, single stalk	271	12.6	8.3	20.9	60
Total, single stalk	6,978	124.7	351.1	535.9	.....	Total, wide spaced	2,191	102.1	170.7	272.8	.....
Total, wide spaced	2,299	66.3	144.0	242.0	.....	Total, single stalk	6,840	197.5	228.3	425.8	.....
Average, single stalk	349	7.3	20.65	26.8	.....	Average, wide spaced	110	5.1	8.5	13.64	.....
Average, wide spaced	115	3.9	8.47	12.1	.....	Average, single stalk	342	9.87	11.4	21.3	.....
Open crop, single stalk, per cent	.....	26.2	73.8	100.0	.....	Open crop, wide spaced, per cent	.....	37.4	62.6	100.0	.....
Open crop, wide spaced, per cent	.....	31.5	68.5	100.0	.....	Open crop, single stalk, per cent	.....	46.4	53.6	100.0	.....
Acre yield, single stalk, pounds	.....	.....	.....	1071	.....	Acre yield, wide spaced, pounds	.....	.....	.....	546	.....
Acre yield, wide spaced, pounds	.....	.....	.....	484	.....	Acre yield, single stalk, pounds	.....	.....	.....	852	.....
Increase, single stalk, per cent	.....	88	144	121.5	121.5	Increase, single stalk, per cent	.....	93.5	33.7	56.1	56.1

[a] Not included in total.

The yields from the alternate blocks of section B shown in Table VI represent more nearly what may be expected under field conditions. The results are similar to those obtained from the alternate rows in section A, though the differences are less extreme. The total yields from the wide-spaced rows ranged from 10.3 to 17 pounds and those from the single-stalk rows from 17.2 to 25.2 pounds, the minimum yield from the single-stalk rows being practically the same as the maximum yield from the wide-spaced rows. These results are presented graphically in figure 3. At the time the first picking was made, August 11, 37 per cent of the crop in the wide-spaced rows was

FIG. 2.—Diagram showing the yields from single-stalk and wide-spaced rows of Acala cotton in section A, San Antonio, Tex., in 1914. Wide-spaced rows represented by double lines, single-stalk rows by heavy lines.

harvested, as compared with 47 per cent of the crop in the single-stalk rows, the latter yielding 93 per cent more seed cotton. The second picking from the single-stalk rows was 33.7 per cent greater than that from the wide-spaced rows. The increase in the total yield of individual rows in any single-stalk block over the corresponding rows in the preceding wide-spaced block ranged from 15 to 119 per cent, the average being 56.1 per cent.

Reference to figure 3 will show that in most cases the inside rows of wide-spaced blocks and the outside rows of single-stalk blocks yielded more than the other two rows of the same blocks. This

END VIEW OF THE SINGLE-STALK ROW OF BLACKSEED COTTON SHOWN IN PLATE III, FIGURE 1, IN WHICH THE CORRESPONDING PLANTS ARE DESIGNATED BY THE SAME LETTERS USED HERE.

This illustrates the form of row common to the single-stalk system of culture. Note how the plants lean to one side or the other.

ALTERNATING SINGLE-STALK AND WIDE-SPACED ROWS OF ACALA COTTON, WITH THE TOTAL AMOUNT OF SEED COTTON TAKEN FROM THEM AT THE ENDS OF THE ROWS.

Note the greater height and the more erect habit of growth of the single-stalk rows, which are represented by the larger piles of cotton.

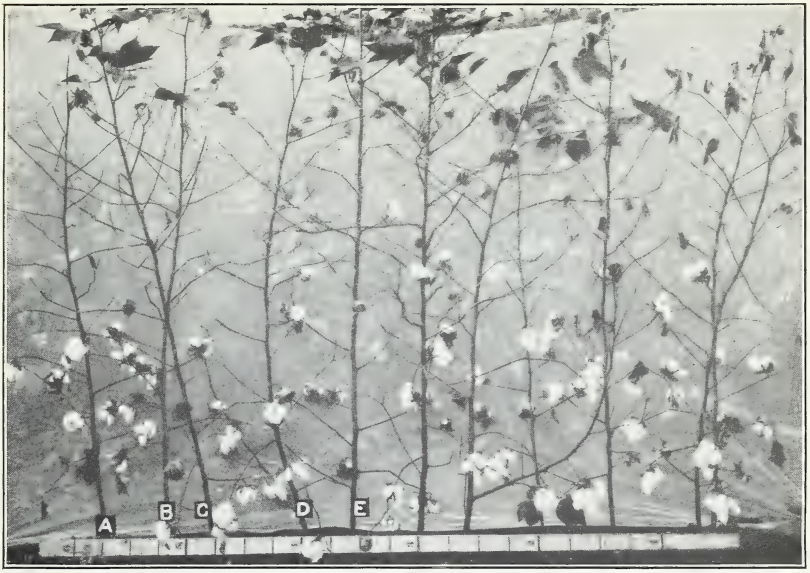

FIG. 1.—SIDE VIEW OF THE SINGLE-STALK ROW OF BLACKSEED COTTON SHOWN IN PLATE I, THE CORRESPONDING PLANTS BEING DESIGNATED BY THE SAME LETTERS.

These 11 plants, with only 2 vegetative branches, produced a total of 88 bolls. Most of the leaves have been removed to show the branching habit and slender form of the plants. Note the lack of crowding. Compare with Plate III, figure 2. (The plants were 8 feet from the camera when photographed.)

FIG. 2.—SIDE VIEW OF THREE PLANTS IN A WIDE-SPACED ROW OF BLACKSEED COTTON.

These 3 plants bore 11 vegetative branches and produced a total of 67 bolls. They cover the same extent of row space as those in Plate III, figure 1. Most of the leaves have been removed to show the branching habit and bushy form of the plants. (The plants were 8 feet from the camera when photographed.)

FIG. 1.—ELEVEN PLANTS IN A SINGLE-STALK ROW OF ACALA COTTON WITH A TOTAL OF 3 VEGETATIVE BRANCHES AND 59 BOLLS.

This shows a single-stalk row as it should look when properly spaced. Note the absence of vegetative branches and the uniform position of the fruit. Compare with Plate IV, figure 2. (The plants were 8 feet from the camera when photographed.)

FIG. 2.—THREE PLANTS IN A WIDE-SPACED ROW OF ACALA COTTON WITH A TOTAL OF 8 VEGETATIVE BRANCHES AND 33 BOLLS.

Note the development of vegetative branches and the irregular placement of the fruit. Compare with Plate IV, figure 1. (The plants were 8 feet from the camera when photographed.)

FIG. 1.—SIXTEEN PLANTS IN AN UNTHINNED ROW OF ACALA COTTON WITH 10 VEGETATIVE BRANCHES AND 70 BOLLS.

Seven of the 10 vegetative branches were produced on the two end plants of the section, adjacent to open spaces in the row. This illustrates the effectiveness of crowding to suppress the development of vegetative branches. But note the smaller plants, which produced no bolls. This probably is due to the suppression or abortion of fruiting branches, brought on by the overcrowded condition of the row during its fruiting period. Single-stalk culture aims to avoid such a condition. Compare with Plate III, figure 1, and Plate IV, figure 1. (The plants were 8 feet from the camera when photographed.)

FIG. 2.—THE FIRST PICKING OF SEED COTTON FROM ROWS IN SECTION C.

The plants in the rows from left to right were spaced early to 6, 9, 12, 18, and 24 inches, respectively. The yields in pounds per row were 13.2, 11.8, 8.9, 8.6, and 7, respectively. (The piles of cotton were 8 feet from the camera when photographed.)

FIG. 1.—TOTAL YIELDS FROM FOUR CONSECUTIVE WIDE-SPACED ROWS OF ACALA COTTON IN SECTION B, NUMBERED FROM LEFT TO RIGHT 58, 59, 60, AND 61, RESPECTIVELY.

The yields in pounds per row were 14, 15.6, 14.3, and 10.3, respectively. Note the greater yields from the inside rows. Compare with Plate VI, figure 2. (The piles of cotton were 8 feet from the camera when photographed.)

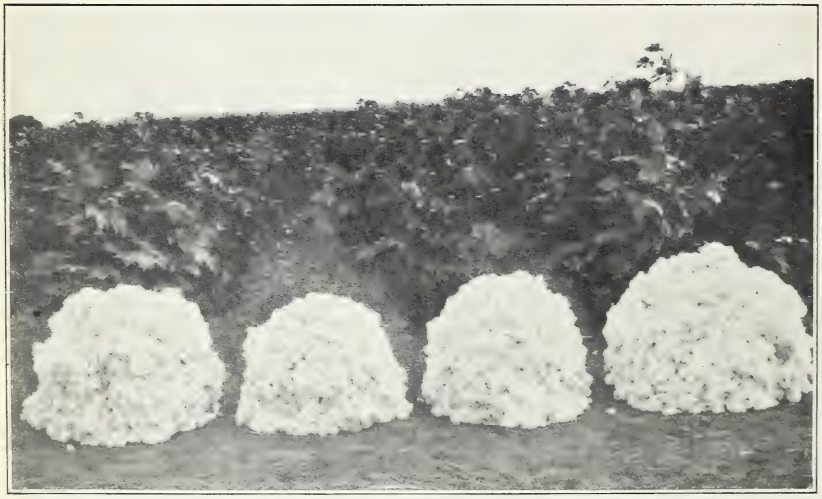

FIG. 2.—TOTAL YIELDS FROM FOUR CONSECUTIVE SINGLE-STALK ROWS OF ACALA COTTON IN SECTION B, NUMBERED FROM RIGHT TO LEFT 62, 63, 64, AND 65, RESPECTIVELY.

The yields in pounds per row were 24.6, 18.7, 17.2, and 22.6, respectively. Note the greater yields from the outside rows. Compare with Plate VI, figure 1. (The piles of cotton were 8 feet from the camera when photographed.)

point is illustrated further in Plate VI, figures 1 and 2, which present yields from rows in wide-spaced and single-stalk blocks, respectively.

General observations made throughout the season, comparing the development of single-stalk and wide-spaced rows, showed how the above conditions might be accounted for. Plants in the single-stalk rows seemed sooner to take advantage of any inter-row or inter-plant soil space and to more readily utilize the available soil moisture. On this account plants in single-stalk rows may have gained an advantage over adjoining wide-spaced rows early in the season and to a degree have invaded the soil that would otherwise have been utilized by the wide-spaced rows. This advantage would be cumulative, and as the season progressed the plants in the single-stalk rows appeared to show distinct superiority in this respect. This may also account

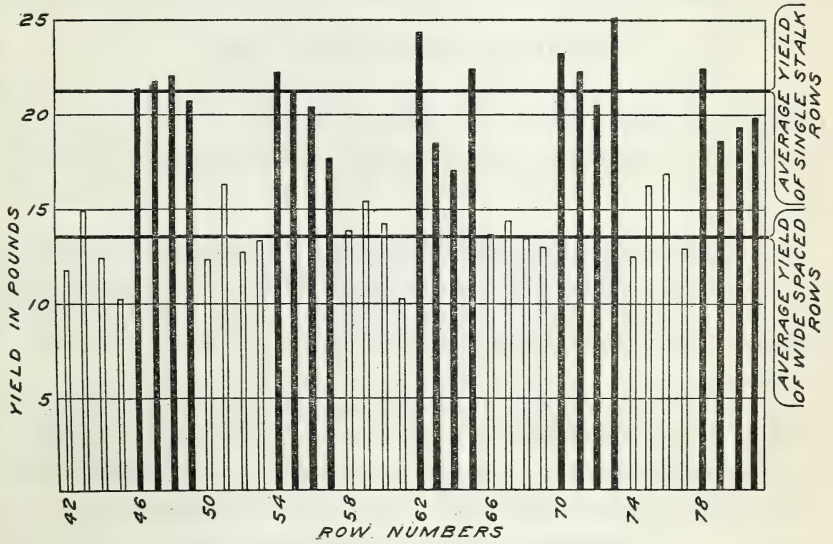

FIG. 3.—Diagram showing the yields from rows in wide-spaced and single-stalk blocks of Acala cotton in section B, San Antonio, Tex., 1914. Wide-spaced rows are represented by double lines, single-stalk rows by heavy lines.

for the greater differences in the yields obtained from the alternate rows of section A.

Because of the effect of single-stalk rows on wide-spaced rows throughout the test, it is necessary to compare the inside rows of the 4-row blocks of section B in order to learn the differences that might be expected if the planting had been made upon a field basis. It is found by doing this that the inside rows of single-stalk blocks yielded from 15 to 60 per cent more seed cotton than the inside rows of the wide-spaced blocks. The average difference is 47.7 per cent.

The yields from the guard row that separated sections A and B proved more interesting than was anticipated. This row, which was not thinned at any time during the season, contained 594 plants and yielded more than either the nearest wide-spaced or single-stalk row. A section of this row is illustrated in Plate V, figure 1. The nonthinned row yielded 23.7 pounds of seed cotton, while the wide-spaced rows on either side yielded 11.4 and 11.7 pounds, respectively. The nearest single-stalk row, the second row distant, yielded 21.6 pounds. The nonthinned row yielded 104 per cent more than the wide-spaced rows and 9 per cent more than the single-stalk rows. The yields from this and other nonthinned rows in the test indicate that the full possibilities of securing advantage from leaving the plants closer together have not yet been obtained in the experiments with the single-stalk system. The fact that the nonthinned row was favorably situated between two wide-spaced rows should not, however, be overlooked.

QUALITY AND QUANTITY OF FIBER.

A careful examination of the fiber in the field resulted in the conclusion that there were no perceptible differences in the quality of the fiber produced on single-stalk and on wide-spaced plants. The length, strength, luster, drag, and evenness were compared and found to be the same.

That even closer spacing than that used in the single-stalk rows does not affect the quality of lint is shown by the fact that the fiber produced in the guard row between sections A and B, which was not thinned at any time during the season, was up to the standard in quality.

The abundance of the lint on the seed was determined as far as possible in the field and found to be the same in the single-stalk and in the wide-spaced rows. An actual ginning test corroborated the field test, proving the lint percentage to be about 32 in each case.

RESULTS IN TIME-OF-THINNING TEST.

The blocks of the "time-of-thinning" test in section C were all planted on April 14 and were thinned 25, 41, and 51 days after planting, respectively. Each block contained five rows, in which the plants were thinned to 6, 9, 12, 18, and 24 inches apart, respectively. It was not possible to arrange the rows in the same order in all of the blocks because of the poor stands in some of the rows, making it necessary to select the best rows for the closer spacings. On account of this irregular method of arrangement and also because the rows are so few in number, only a general statement of the results will be given.

With respect to vegetative-branch development it was found that the longer thinning was delayed the greater was the restriction in the branch development. There was a gradual increase in the number

of branches as the distance between the plants increased, regardless of the time of thinning.

The yields were closely associated with the distance between the plants in the row. This is illustrated in Plate V, figure 2, which shows the first picking from rows of Acala cotton thinned at the ordinary time, the plants being left 6, 9, 12, 18, and 24 inches apart in the different rows. As the distance between the plants increased, the yields decreased.

The rows that were thinned late gave higher yields than those thinned either early or very late.

RESULTS IN DISTANCE-BETWEEN-ROW TEST.

As in other sections the rows in the "distance-between-row" test of section D were planted on April 14. This section contained four blocks, in which the rows were spaced to 3, 4, 5, and 6 feet apart, respectively. The blocks contained 8, 6, 5, and 4 rows, respectively. In all the blocks single-stalk rows alternated with wide-spaced rows. The wide-spaced rows were chopped 25 days after planting and the single-stalk rows 47 days after planting. This test was also limited, and as the results are indicative rather than conclusive only a general summary is given.

The boll census showed that as the distance between the rows increased, the percentage of 4-locked bolls decreased, this decrease being offset by a corresponding increase in the percentage of 5-locked bolls. The wide-spaced rows had a smaller percentage of 4-locked bolls and a greater percentage of 5-locked bolls than the single-stalk rows, regardless of the distance between the rows. Single-stalk rows 6 feet apart gave higher acre yields than wide-spaced rows either 3, 4, 5, or 6 feet apart.

The results of this experiment suggest the desirability of further testing the single-stalk system of culture in rows 5 or more feet apart in dry regions.

SUMMARY.

Drought and boll-weevil ravages shorten the period during which bolls are set in the region of San Antonio, and a cotton crop must be set ordinarily in about one month. In 1914 the crop was set in about 25 days. Because of the very short season of setting the crop, the single-stalk system of cotton culture promises to be especially useful.

The single-stalk and wide-spaced systems of culture were compared in alternate single rows and alternate 4-row blocks in rows 4 feet apart and again in alternating rows 3, 4, 5, and 6 feet apart. In one instance plants were thinned early, late, and very late to 6, 9, 12, 18, and 24 inches apart. The stand was satisfactory in all cases.

The spring of 1914 in the region of San Antonio was cooler than usual, and more than twice the normal amount of rain fell during

April and May. No rain fell between the first of June and early in August. These abnormal conditions caused a restriction in the development of vegetative branches. That the single-stalk system was effective in still further reducing vegetative growth is shown by the fact that even though the average number of vegetative branches produced on plants in wide-spaced rows was only 1.6, on single-stalk plants it was reduced to 0.53 branch per plant.

More flowers were produced daily on the single-stalk rows than on the adjoining wide-spaced rows. At the end of 40 days single-stalk rows alternating with wide-spaced rows had produced 84 per cent more flowers than the latter. In alternating blocks single-stalk rows had produced 78 per cent more flowers than wide-spaced rows in the adjoining block.

Single-stalk rows produced an average of 5.5 bolls per plant and wide-spaced rows 8.6 bolls per plant. The difference in the number of bolls per plant was much more than offset by the greater number of plants in the single-stalk rows, so that the single-stalk rows set from 50 to 150 per cent more bolls in the same row space.

A larger percentage of 4-locked bolls was produced in single-stalk rows and in rows close together than in wide-spaced rows where the plants were set either close together or far apart.

The bolls in the single-stalk rows were slightly smaller than those in the wide-spaced rows. Nineteen 4-locked bolls from single-stalk rows were required to equal the weight of eighteen 4-locked bolls from wide-spaced plants. The ratio of weight for 5-locked bolls is 11 to 10 for single-stalk and wide-spaced rows, respectively.

The plants in single-stalk rows were taller than those in wide-spaced rows. The single-stalk rows were spreading at the top, while the wide-spaced rows were broader near the ground.

In all cases single-stalk rows yielded more than the adjoining wide-spaced rows, regardless of the distance between the rows.

An examination of the fiber in the field showed that there was no perceptible difference in the quality or quantity of lint produced in single-stalk and in wide-spaced rows.

Plants thinned to a few inches apart in the row had fewer vegetative branches than plants spaced farther apart, the thinning having been done at the same time in each case. Late-thinned plants had fewer vegetative branches than plants thinned earlier to the same distance.

Early thinning and late thinning gave higher yields than very late thinning.

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